FIG. 1A

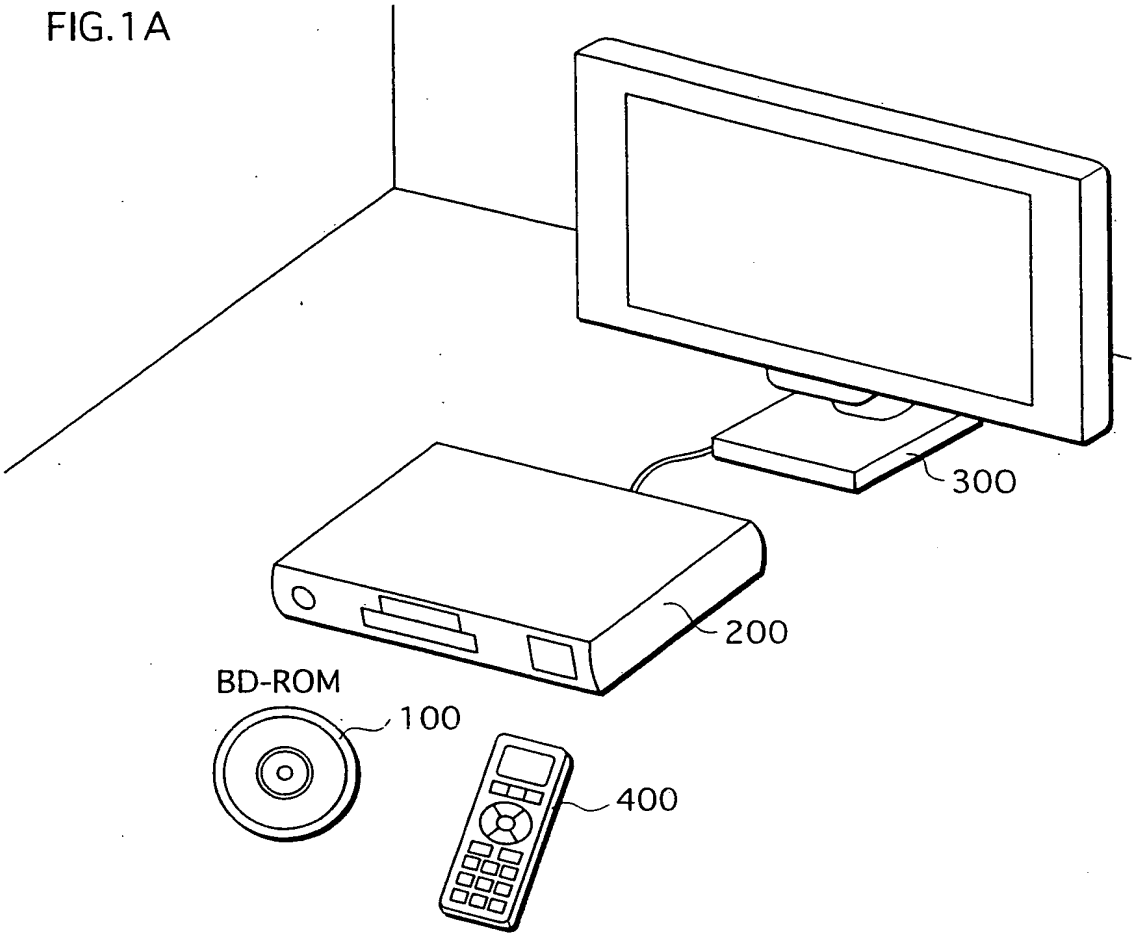

300
200
BD-ROM
100
400

FIG. 1B

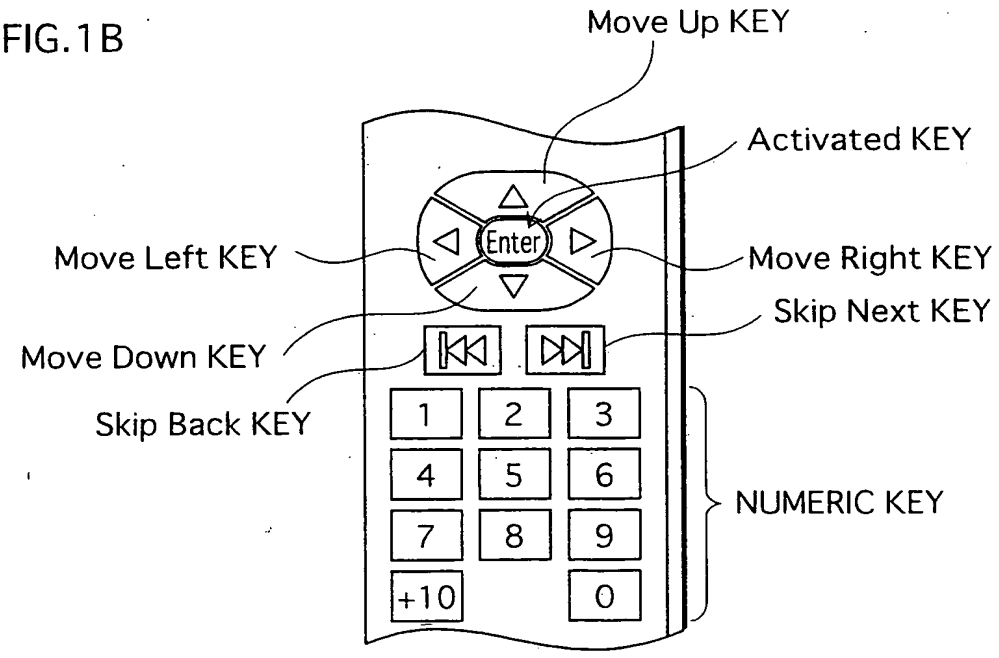

Move Up KEY
Activated KEY
Move Left KEY
Enter
Move Right KEY
Move Down KEY
Skip Next KEY
Skip Back KEY
1
2
3
4
5
6
7
8
9
+10
0
NUMERIC KEY

FIG.2

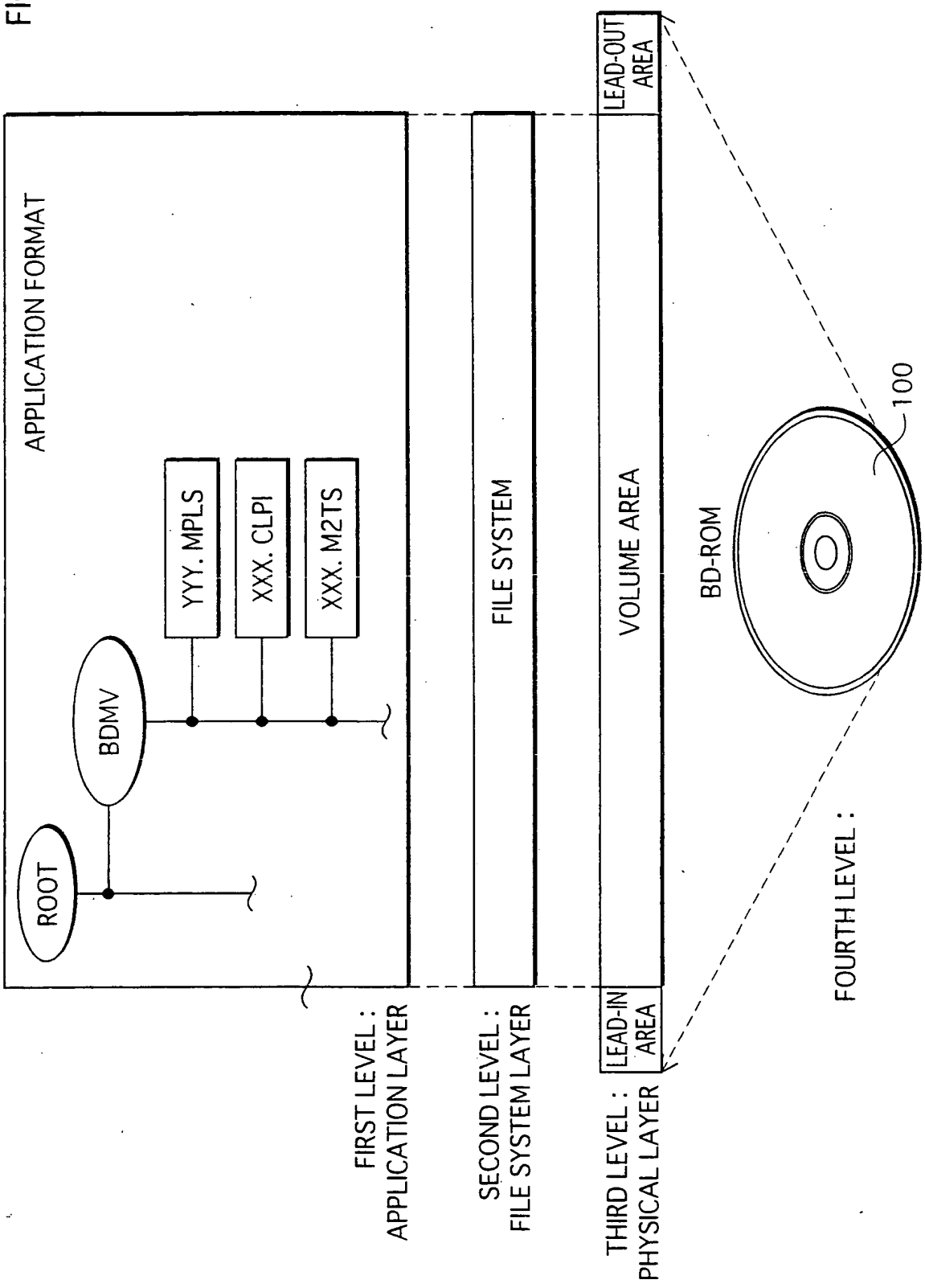

APPLICATION FORMAT
ROOT
BDMV
YYY. MPLS
XXX. CLPI
XXX. M2TS
FILE SYSTEM
VOLUME AREA
LEAD-OUT AREA
LEAD-IN AREA
BD-ROM
100
FIRST LEVEL : APPLICATION LAYER
SECOND LEVEL : FILE SYSTEM LAYER
THIRD LEVEL : PHYSICAL LAYER
FOURTH LEVEL :

FIG.3

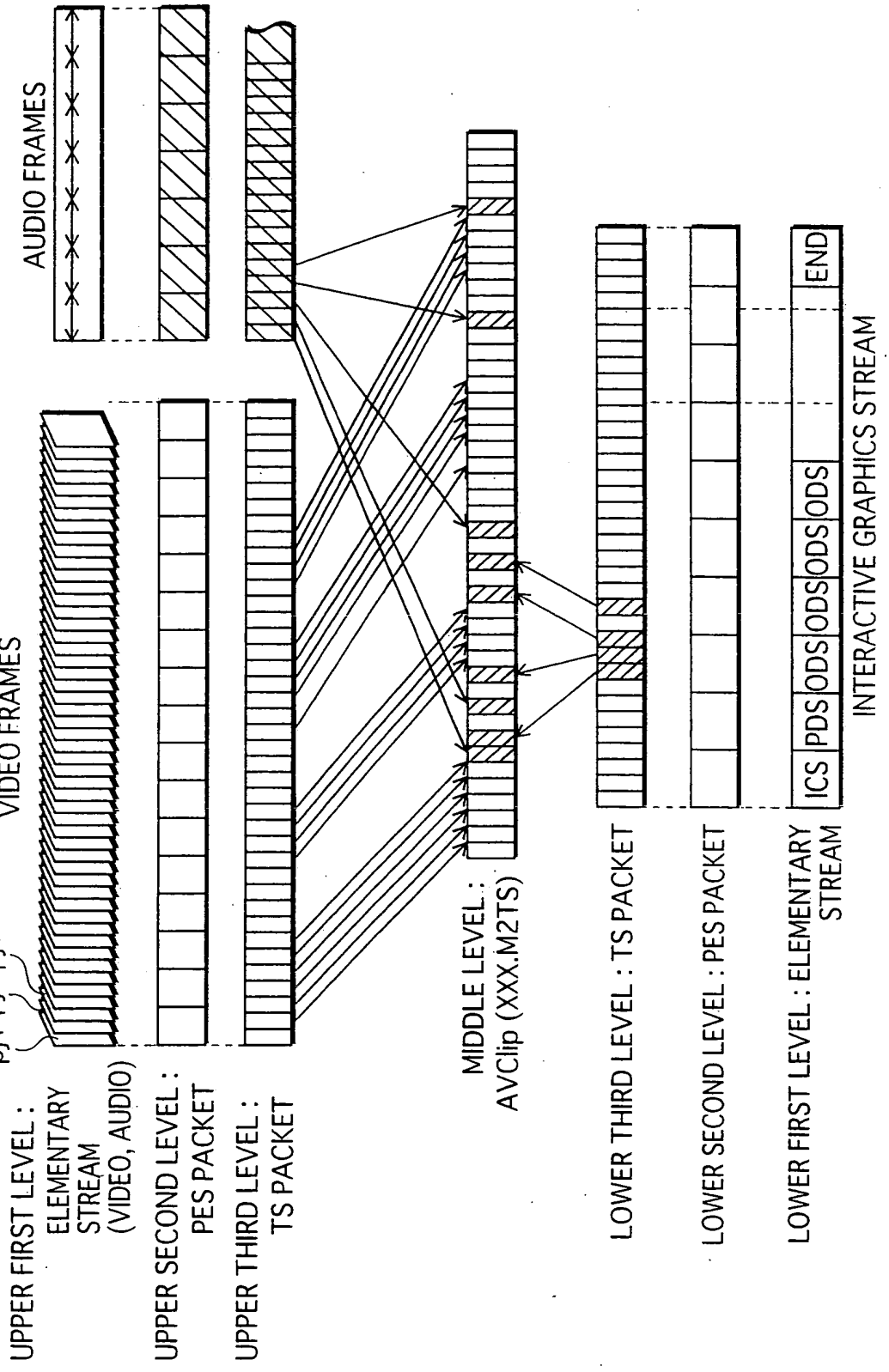

AUDIO FRAMES
VIDEO FRAMES
pj1 pj2 pj3
UPPER FIRST LEVEL : ELEMENTARY STREAM (VIDEO, AUDIO)
UPPER SECOND LEVEL : PES PACKET
UPPER THIRD LEVEL : TS PACKET
MIDDLE LEVEL : AVClip (XXX.M2TS)
LOWER THIRD LEVEL : TS PACKET
LOWER SECOND LEVEL : PES PACKET
LOWER FIRST LEVEL : ELEMENTARY STREAM
ICS
PDS
ODS
ODS
ODS
ODS
END
INTERACTIVE GRAPHICS STREAM

FIG.4

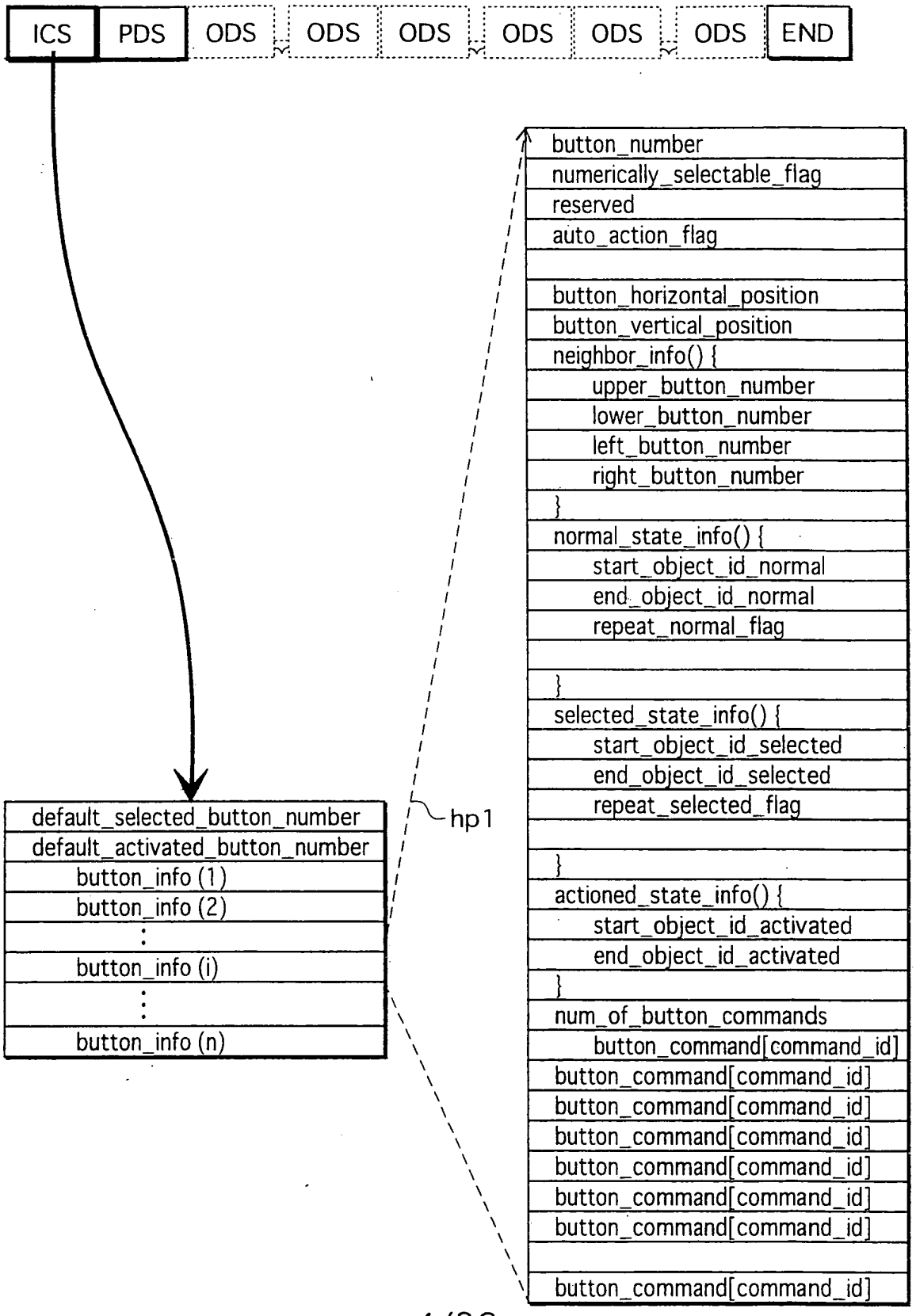

ICS
PDS
ODS
ODS
ODS
ODS
ODS
ODS
END
default_selected_button_number
default_activated_button_number
button_info (1)
button_info (2)
button_info (i)
button_info (n)
hp1
button_number
numerically_selectable_flag
reserved
auto_action_flag
button_horizontal_position
button_vertical_position
neighbor_info() {
upper_button_number
lower_button_number
left_button_number
right_button_number
}
normal_state_info() {
start_object_id_normal
end_object_id_normal
repeat_normal_flag
}
selected_state_info() {
start_object_id_selected
end_object_id_selected
repeat_selected_flag
}
actioned_state_info() {
start_object_id_activated
end_object_id_activated
}
num_of_button_commands
button_command[command_id]
button_command[command_id]
button_command[command_id]
button_command[command_id]
button_command[command_id]
button_command[command_id]
button_command[command_id]

FIG.5

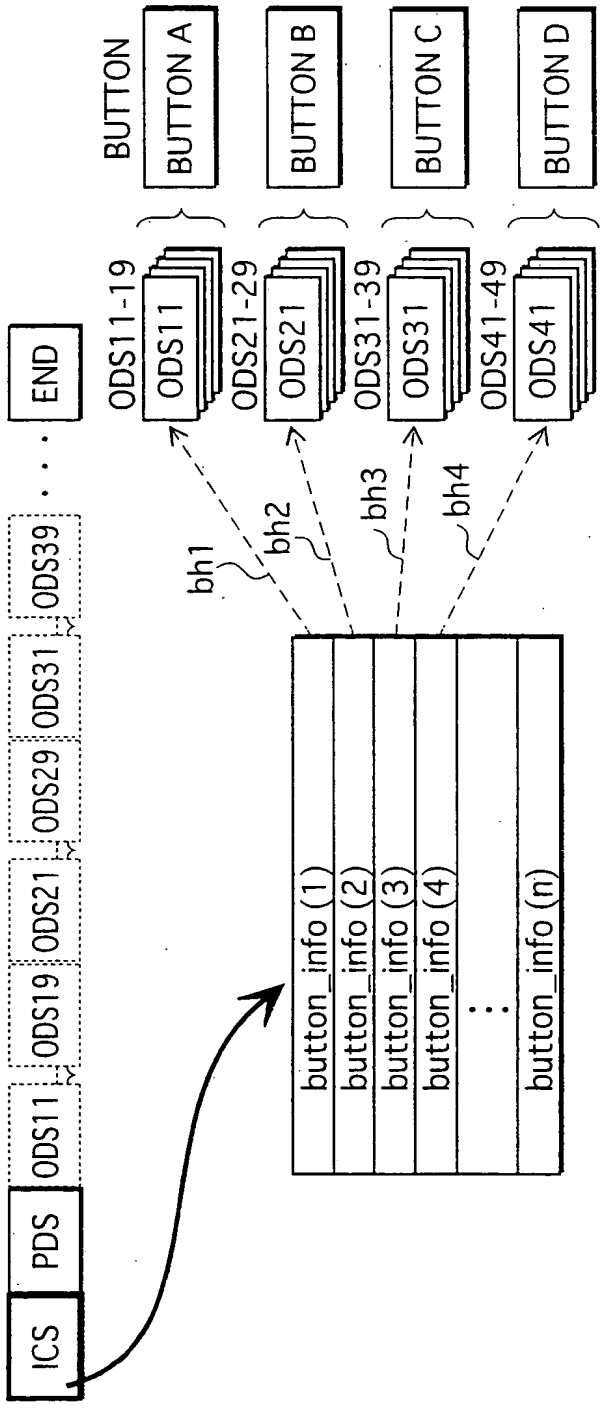

ICS
PDS
ODS11
ODS19
ODS21
ODS29
ODS31
ODS39
END
BUTTON
BUTTON A
BUTTON B
BUTTON C
BUTTON D
ODS11-19
ODS11
ODS21-29
ODS21
ODS31-39
ODS31
ODS41-49
ODS41
bh1
bh2
bh3
bh4
button_info (1)
button_info (2)
button_info (3)
button_info (4)
button_info (n)

FIG.6

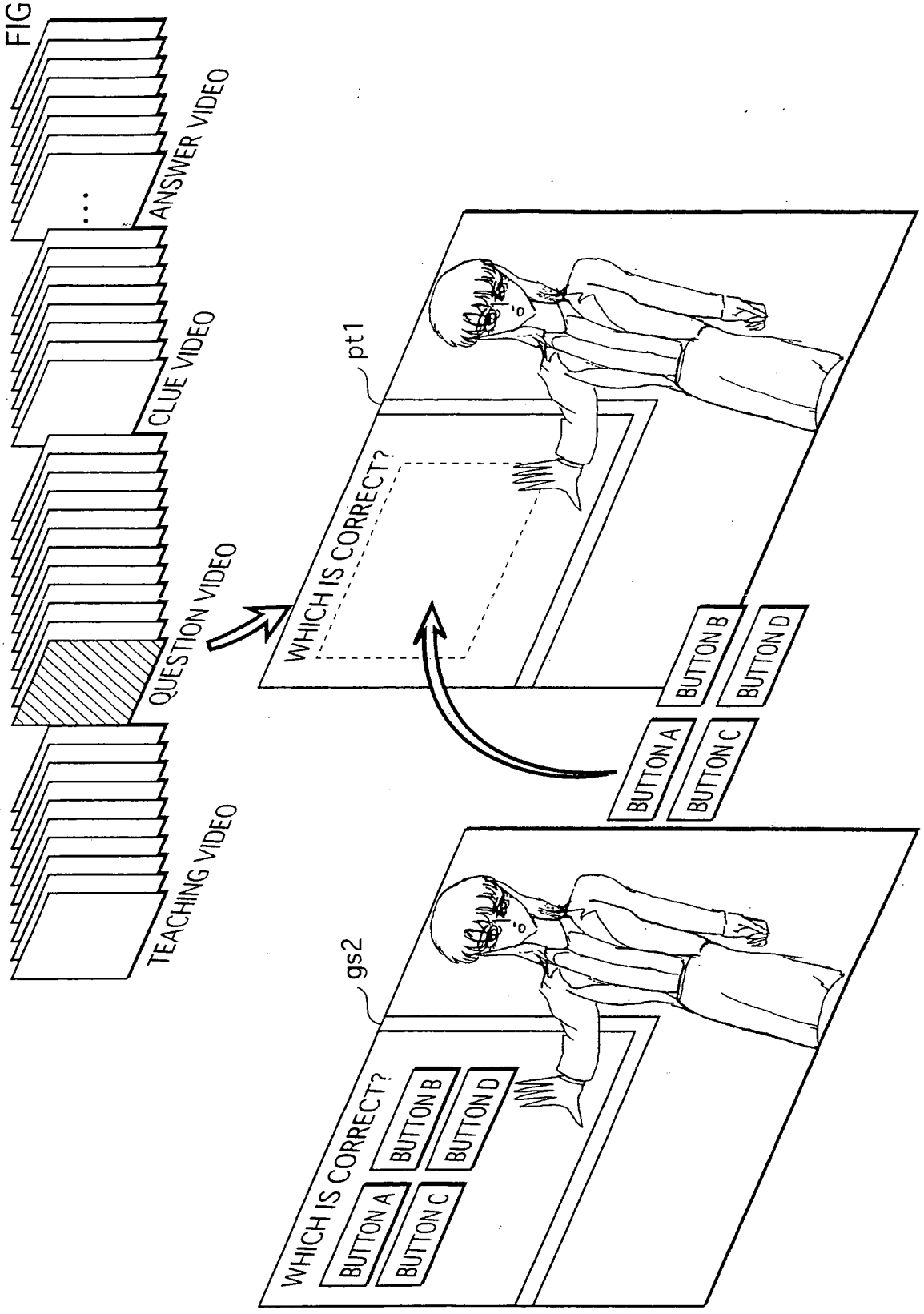

ANSWER VIDEO
CLUE VIDEO
QUESTION VIDEO
TEACHING VIDEO
pt1
WHICH IS CORRECT?
BUTTON B
BUTTON D
BUTTON A
BUTTON C
gs2
WHICH IS CORRECT?
BUTTON B
BUTTON D
BUTTON A
BUTTON C

FIG.7

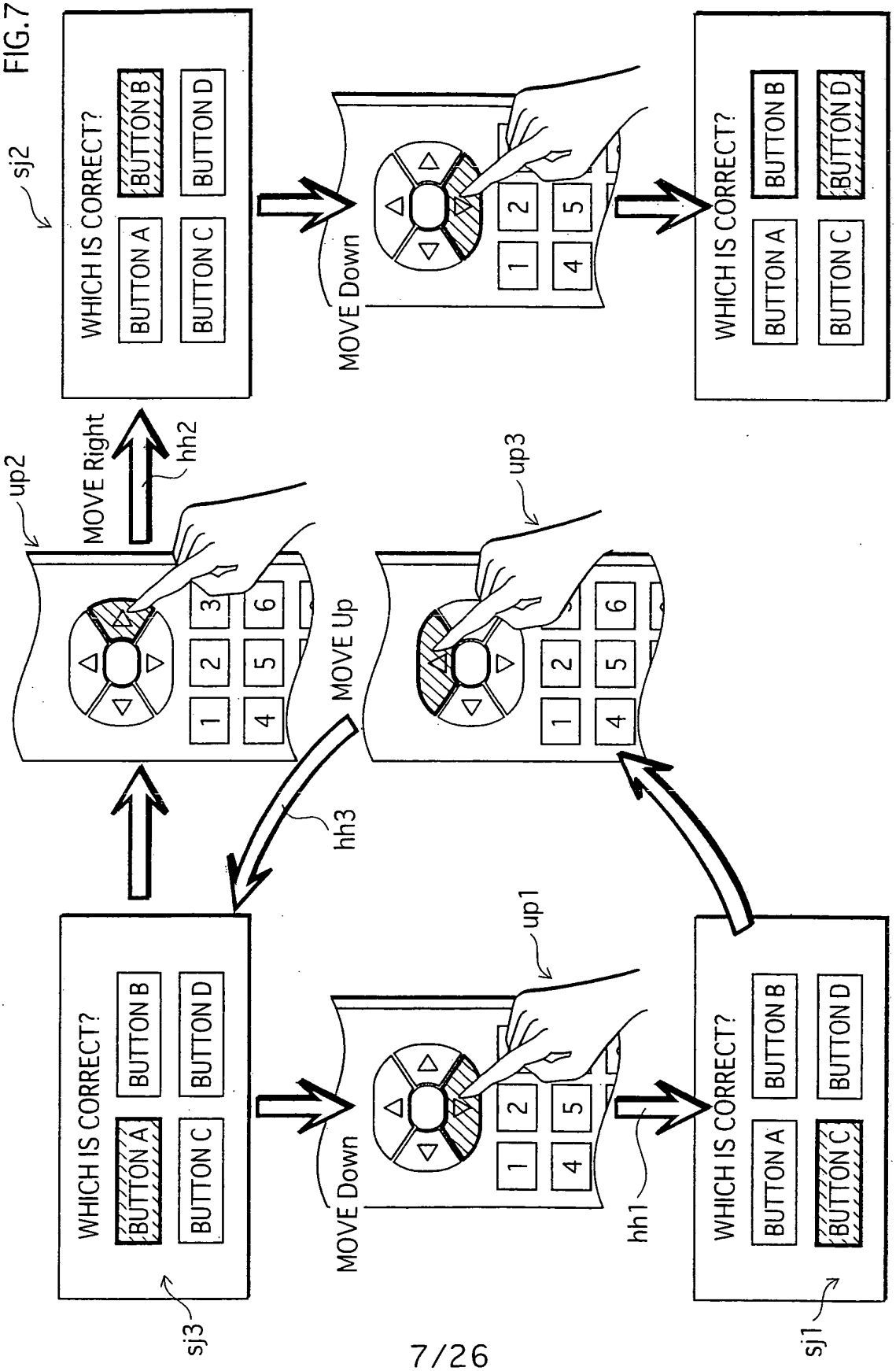

sj2
WHICH IS CORRECT?
BUTTON A
BUTTON B
BUTTON C
BUTTON D
MOVE Down
up2
MOVE Right
hh2
up3
MOVE Up
hh3
up1
hh1
sj3
sj1

FIG.8

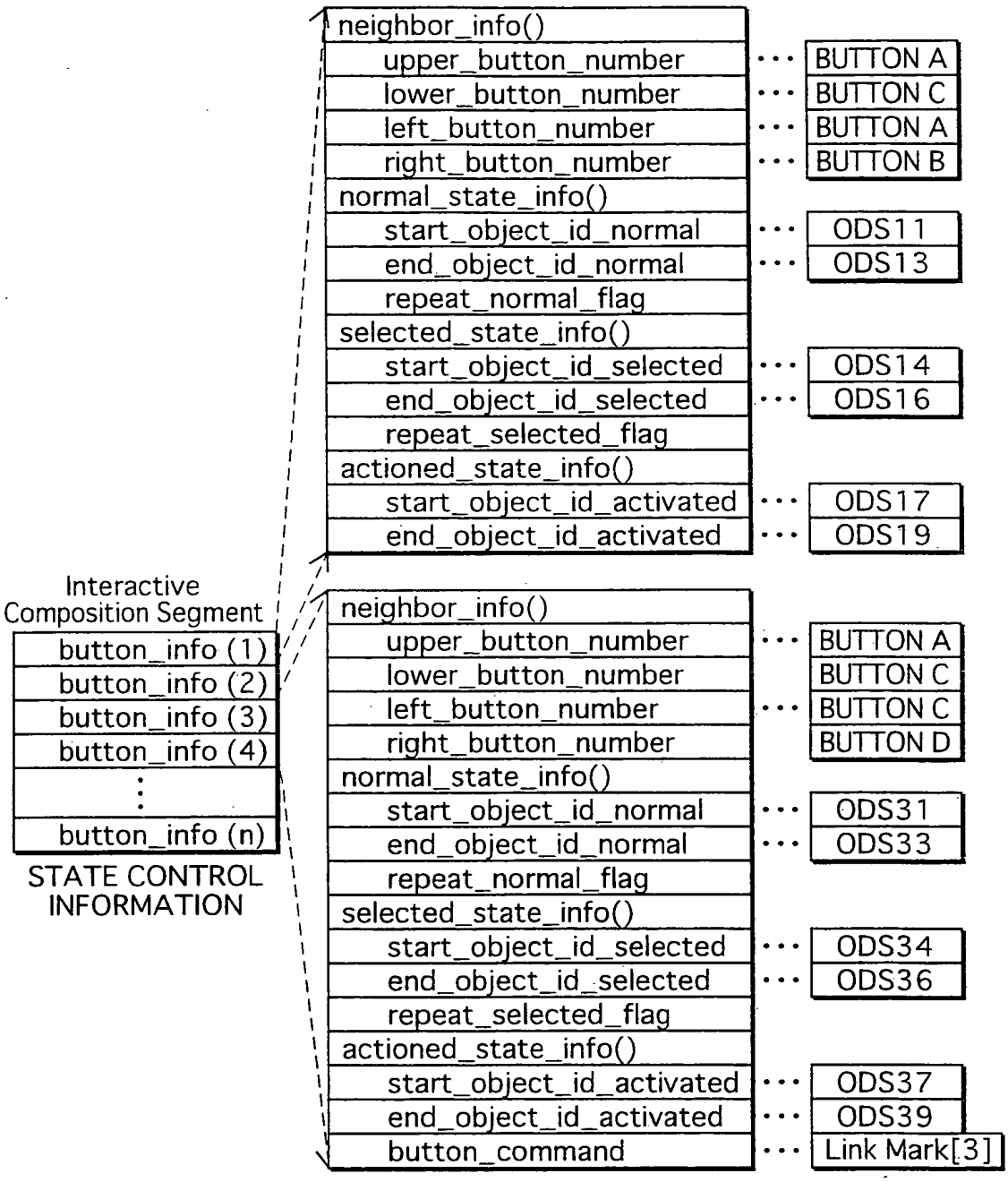

Interactive Composition Segment
button_info (1)
button_info (2)
button_info (3)
button_info (4)
button_info (n)
STATE CONTROL INFORMATION
neighbor_info()
upper_button_number
lower_button_number
left_button_number
right_button_number
normal_state_info()
start_object_id_normal
end_object_id_normal
repeat_normal_flag
selected_state_info()
start_object_id_selected
end_object_id_selected
repeat_selected_flag
actioned_state_info()
start_object_id_activated
end_object_id_activated
BUTTON A
BUTTON C
BUTTON A
BUTTON B
ODS11
ODS13
ODS14
ODS16
ODS17
ODS19
neighbor_info()
upper_button_number
lower_button_number
left_button_number
right_button_number
normal_state_info()
start_object_id_normal
end_object_id_normal
repeat_normal_flag
selected_state_info()
start_object_id_selected
end_object_id_selected
repeat_selected_flag
actioned_state_info()
start_object_id_activated
end_object_id_activated
button_command
BUTTON A
BUTTON C
BUTTON C
BUTTON D
ODS31
ODS33
ODS34
ODS36
ODS37
ODS39
Link Mark[3]

FIG.9

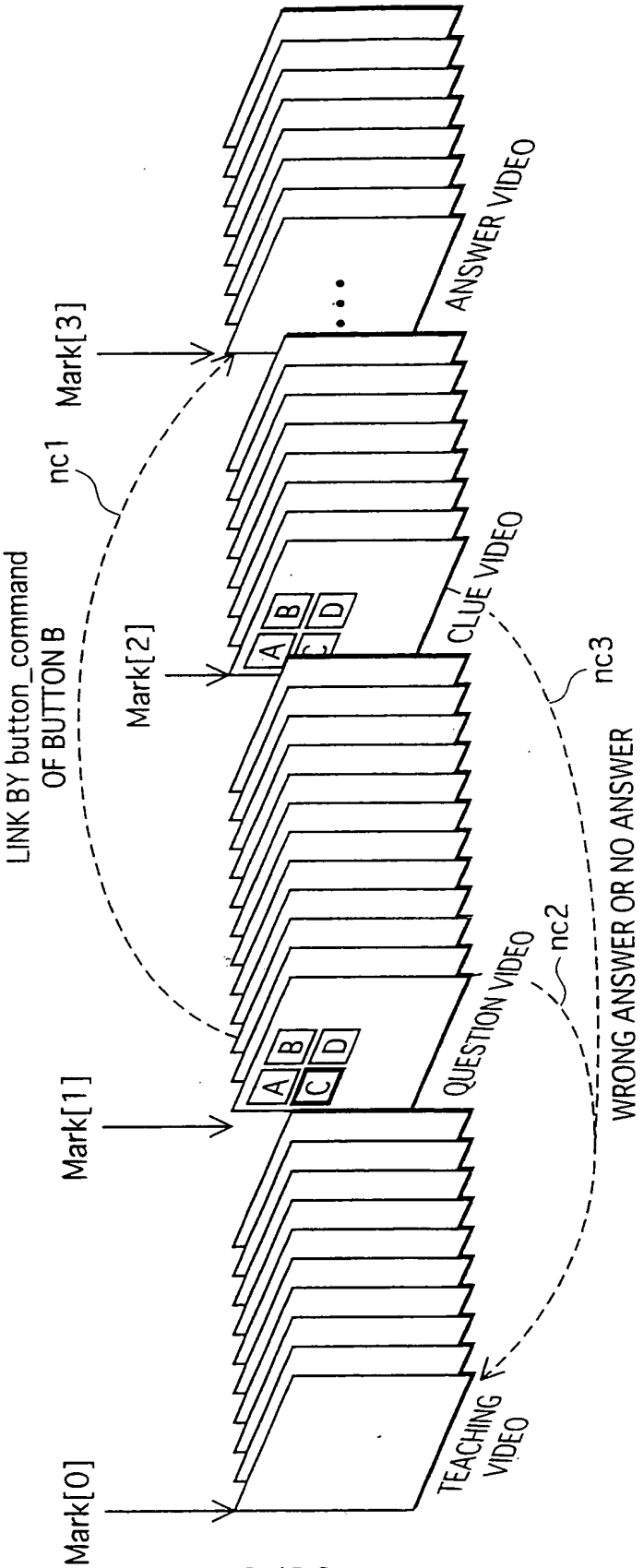
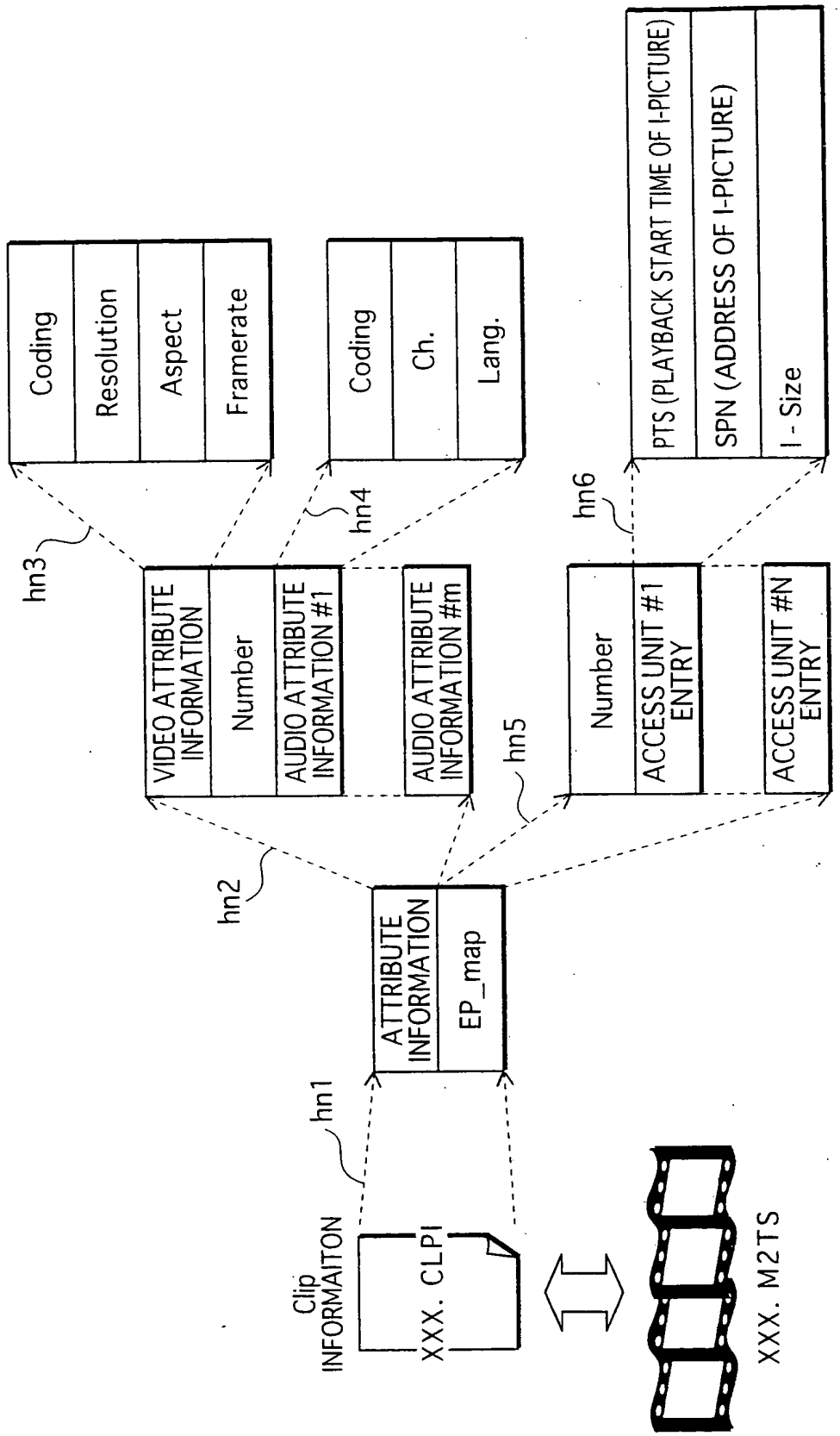

ANSWER VIDEO
Mark[3]
nc1
LINK BY button_command
OF BUTTON B
CLUE VIDEO
Mark[2]
A
B
C
D
nc3
WRONG ANSWER OR NO ANSWER
nc2
QUESTION VIDEO
Mark[1]
TEACHING VIDEO
Mark[0]

FIG.10


Clip INFORMAITON
XXX. CLPI
XXX. M2TS
hn1
hn2
hn3
hn4
hn5
hn6
ATTRIBUTE INFORMATION
EP_map
VIDEO ATTRIBUTE INFORMATION
Number
AUDIO ATTRIBUTE INFORMATION #1
AUDIO ATTRIBUTE INFORMATION #m
Coding
Resolution
Aspect
Framerate
Coding
Ch.
Lang.
Number
ACCESS UNIT #1 ENTRY
ACCESS UNIT #N ENTRY
PTS (PLAYBACK START TIME OF I-PICTURE)
SPN (ADDRESS OF I-PICTURE)
I - Size

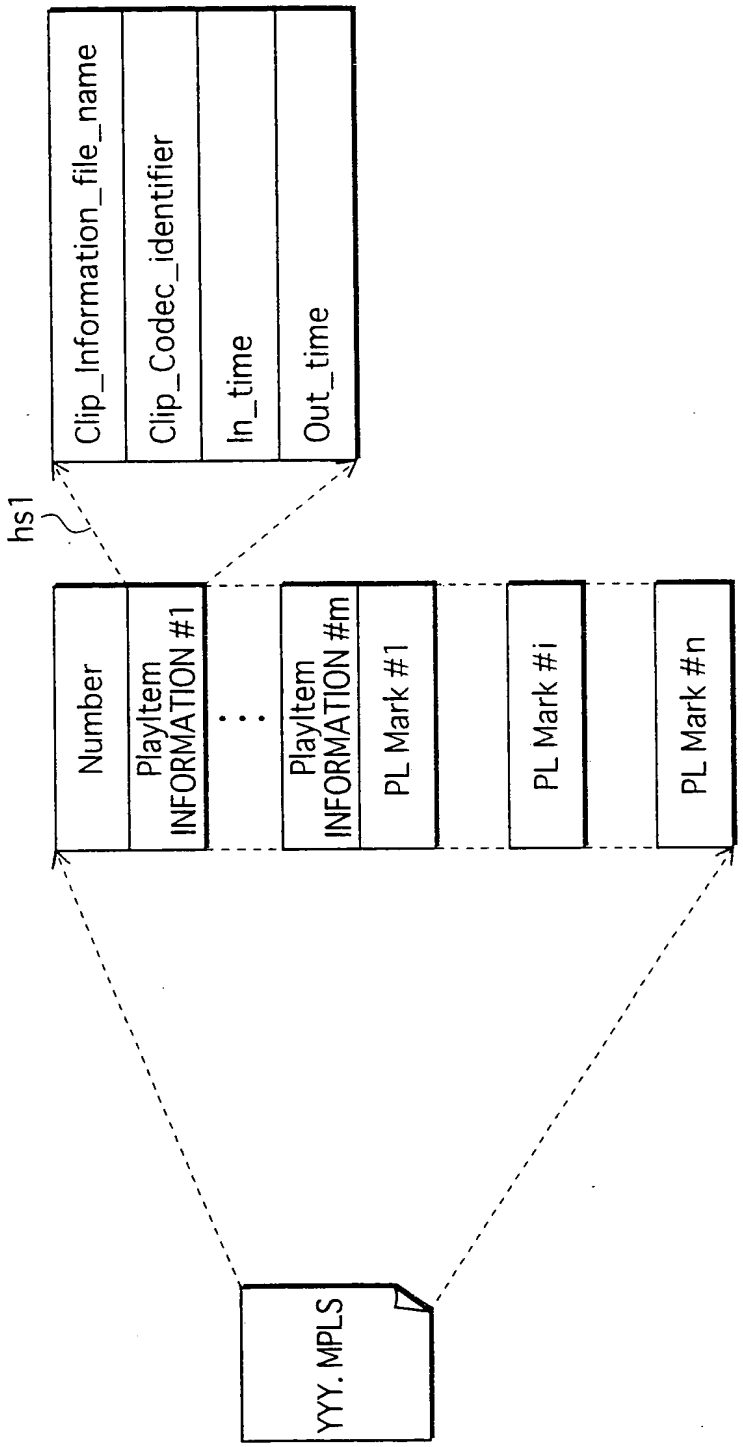
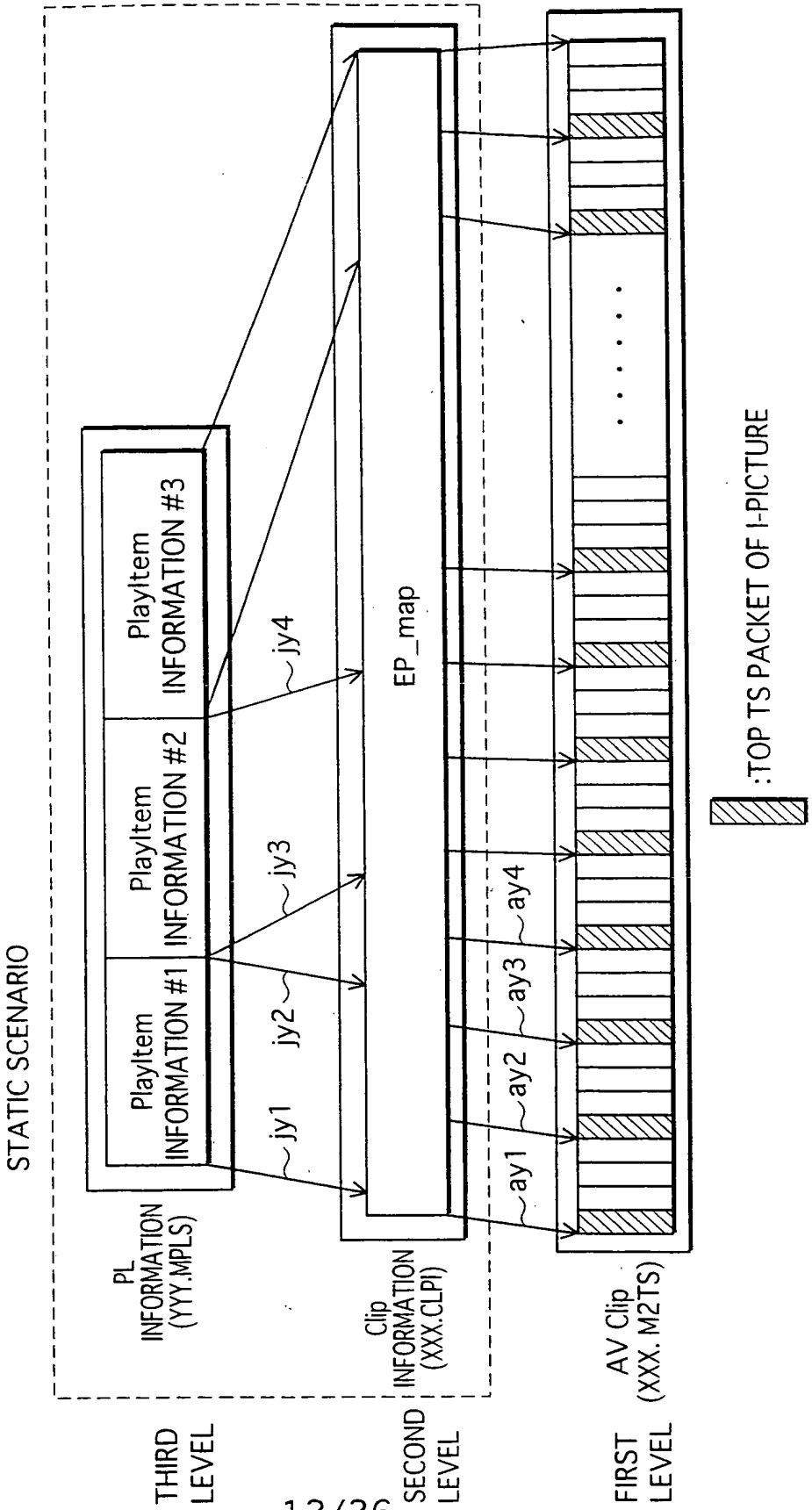

Clip_Information_file_name
Clip_Codec_identifier
In_time
Out_time
hs1
Number
PlayItem INFORMATION #1
PlayItem INFORMATION #m
PL Mark #1
PL Mark #i
PL Mark #n
YYY. MPLS

FIG.11

FIG.12


STATIC SCENARIO
PL INFORMATION (YYY.MPLS)
PlayItem INFORMATION #1
PlayItem INFORMATION #2
PlayItem INFORMATION #3
jy1
jy2
jy3
jy4
Clip INFORMATION (XXX.CLPI)
EP_map
AV Clip (XXX. M2TS)
ay1
ay2
ay3
ay4
: TOP TS PACKET OF I-PICTURE
THIRD LEVEL
SECOND LEVEL
FIRST LEVEL

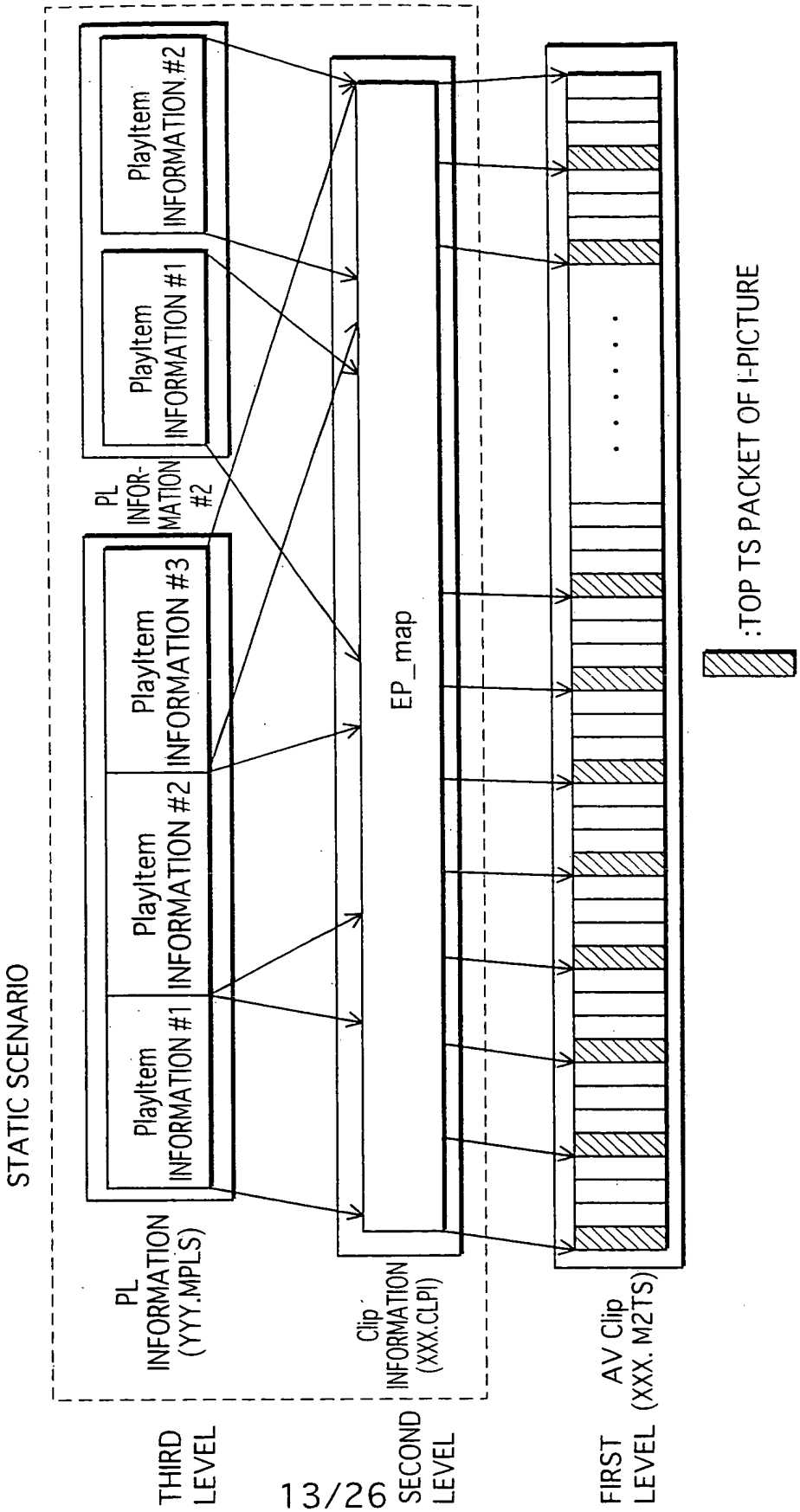

STATIC SCENARIO
PL INFORMATION (YYY.MPLS)
PL INFOR-MATION #2
PlayItem INFORMATION #1
PlayItem INFORMATION #2
PlayItem INFORMATION #3
PlayItem INFORMATION #1
PlayItem INFORMATION #2
Clip INFORMATION (XXX.CLPI)
EP_map
AV Clip (XXX. M2TS)
:TOP TS PACKET OF I-PICTURE
THIRD LEVEL
SECOND LEVEL
FIRST LEVEL

FIG.13

FIG.14

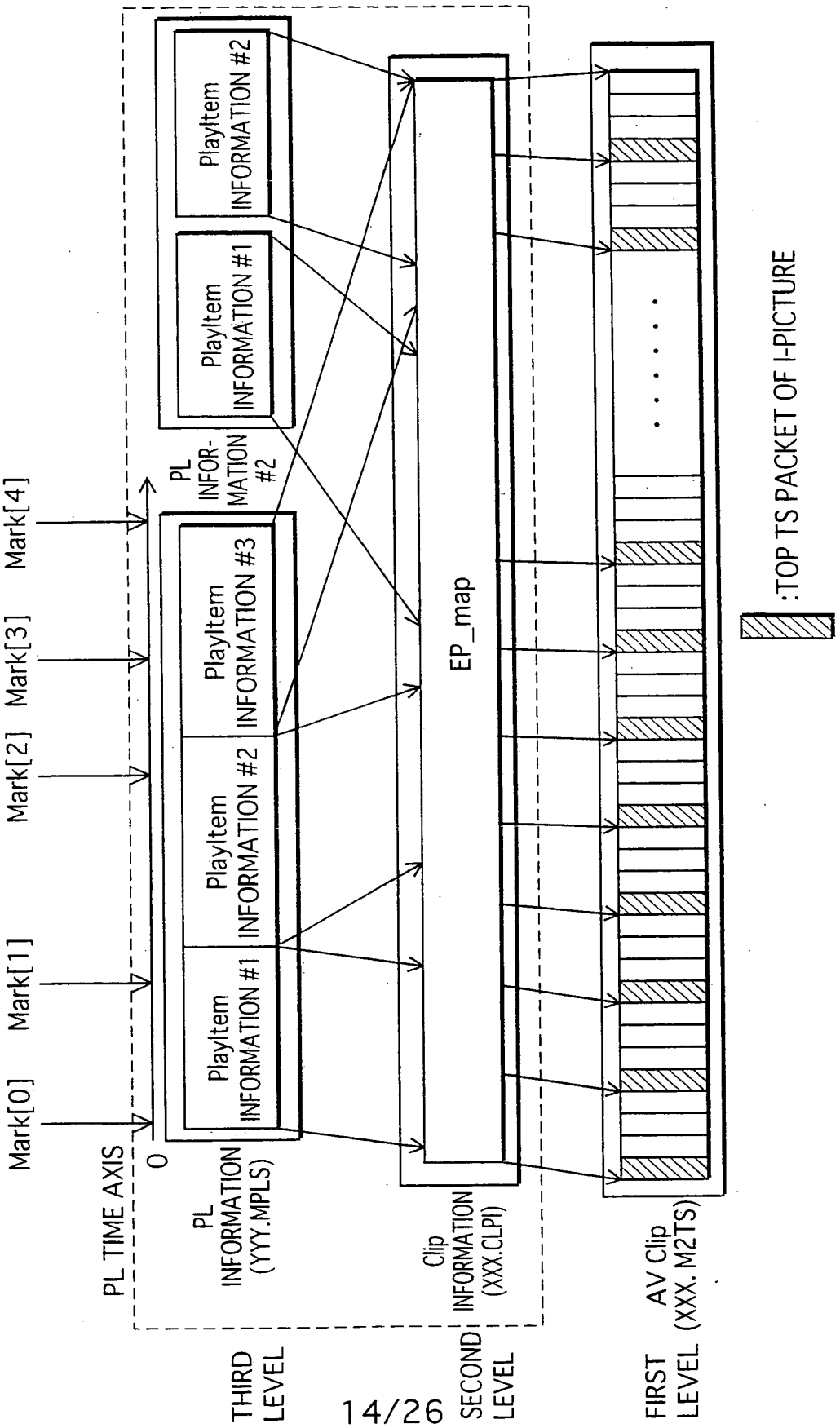

PL TIME AXIS
Mark[0]
Mark[1]
Mark[2]
Mark[3]
Mark[4]
0
PL INFORMATION (YYY.MPLS)
PL INFOR-MATION #2
PlayItem INFORMATION #1
PlayItem INFORMATION #2
PlayItem INFORMATION #3
PlayItem INFORMATION #1
PlayItem INFORMATION #2
EP_map
Clip INFORMATION (XXX.CLPI)
AV Clip (XXX. M2TS)
:TOP TS PACKET OF I-PICTURE
THIRD LEVEL
SECOND LEVEL
FIRST LEVEL

FIG. 15

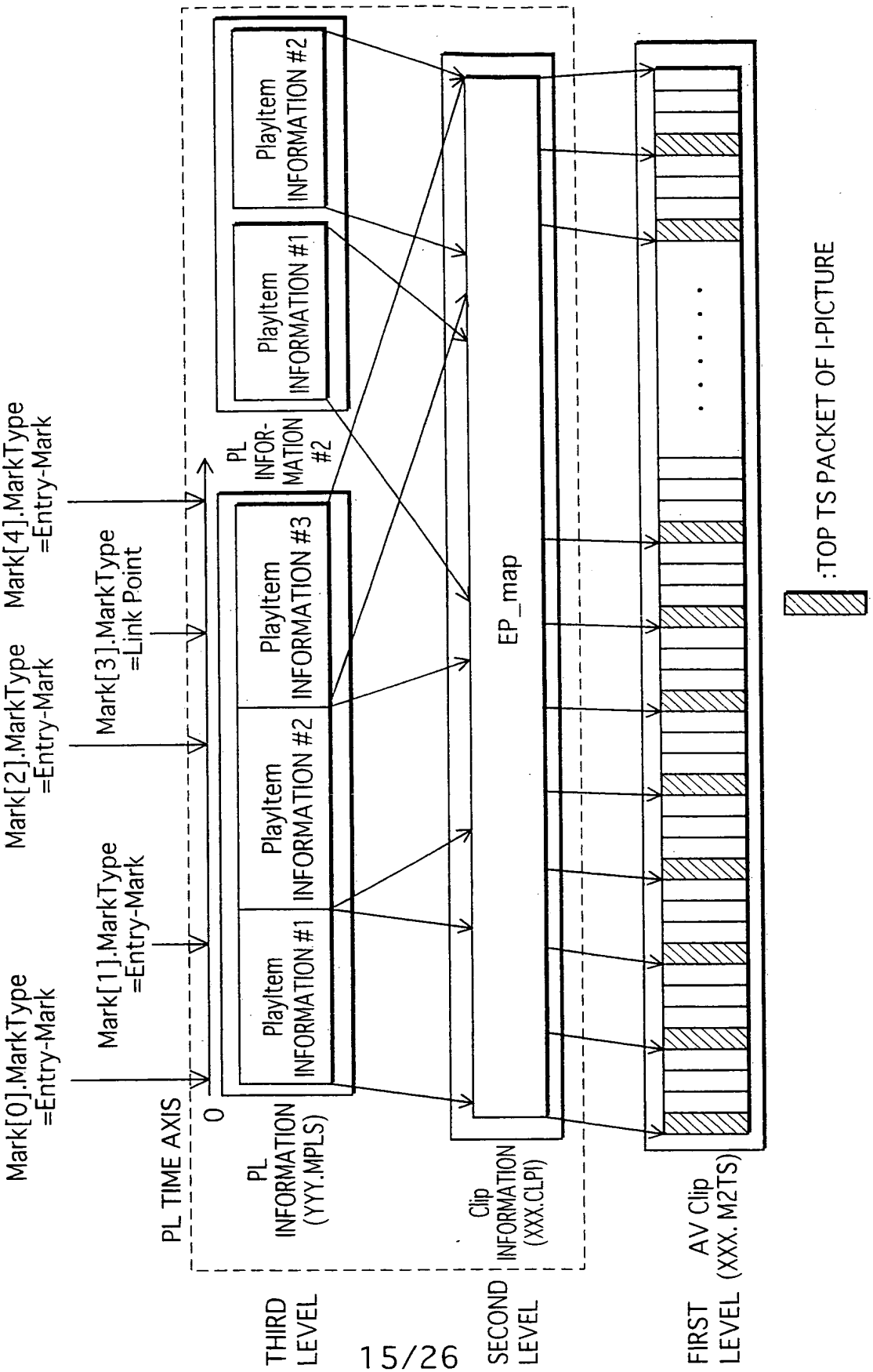
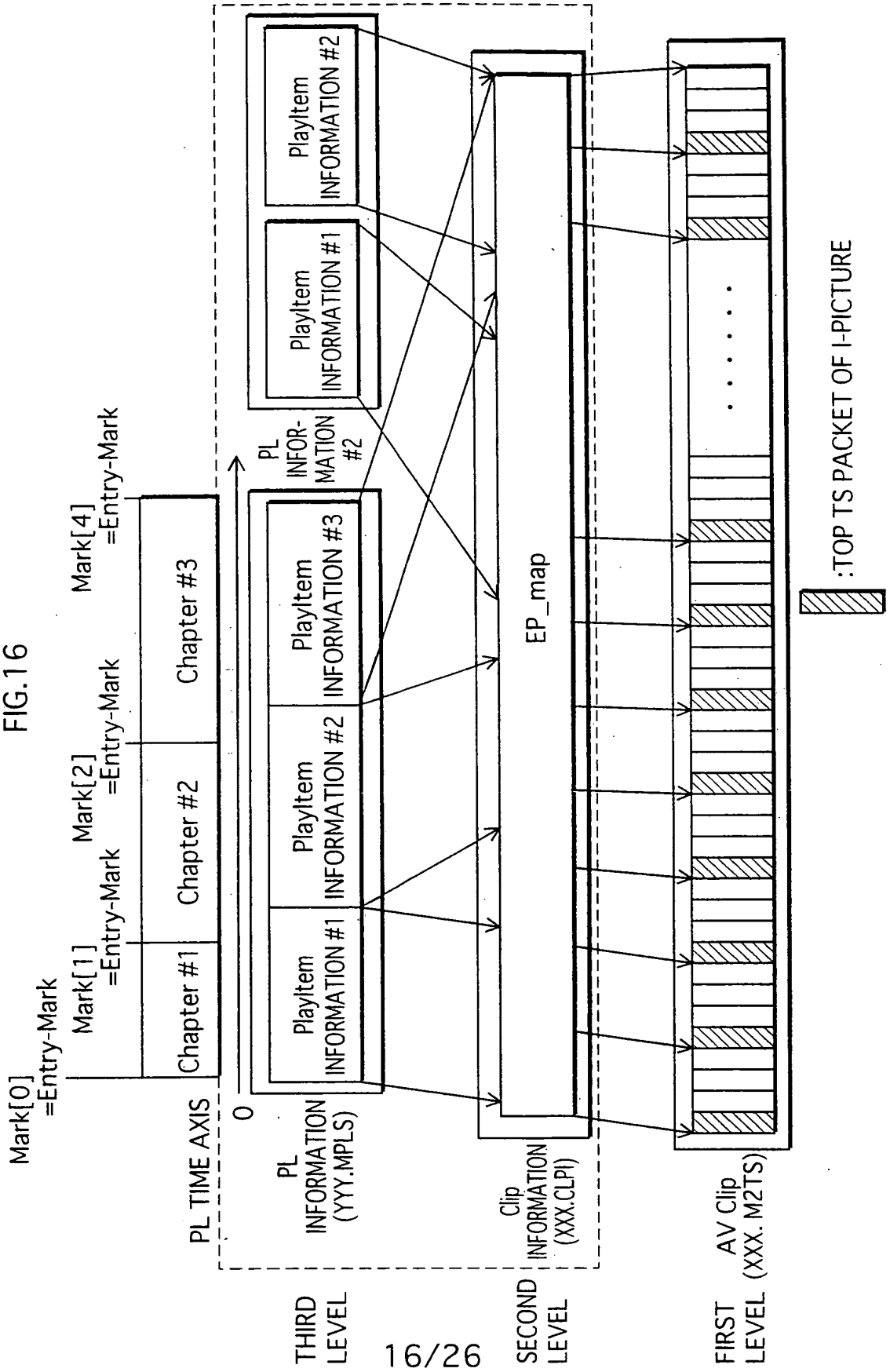

Mark[0].MarkType =Entry-Mark
Mark[1].MarkType =Entry-Mark
Mark[2].MarkType =Entry-Mark
Mark[3].MarkType =Link Point
Mark[4].MarkType =Entry-Mark
PL TIME AXIS
0
PL INFORMATION (YYY.MPLS)
PlayItem INFORMATION #1
PlayItem INFORMATION #2
PlayItem INFORMATION #3
PL INFOR-MATION #2
PlayItem INFORMATION #1
PlayItem INFORMATION #2
EP_map
Clip INFORMATION (XXX.CLPI)
AV Clip (XXX. M2TS)
:TOP TS PACKET OF I-PICTURE
THIRD LEVEL
SECOND LEVEL
FIRST LEVEL

FIG.16


Mark[0] =Entry-Mark
Mark[1] =Entry-Mark
Mark[2] =Entry-Mark
Mark[4] =Entry-Mark
Chapter #1
Chapter #2
Chapter #3
PL TIME AXIS
0
PL INFORMATION (YYY.MPLS)
PlayItem INFORMATION #1
PlayItem INFORMATION #2
PlayItem INFORMATION #3
PL INFOR-MATION #2
PlayItem INFORMATION #1
PlayItem INFORMATION #2
EP_map
Clip INFORMATION (XXX.CLPI)
AV Clip (XXX. M2TS)
:TOP TS PACKET OF I-PICTURE
THIRD LEVEL
SECOND LEVEL
FIRST LEVEL

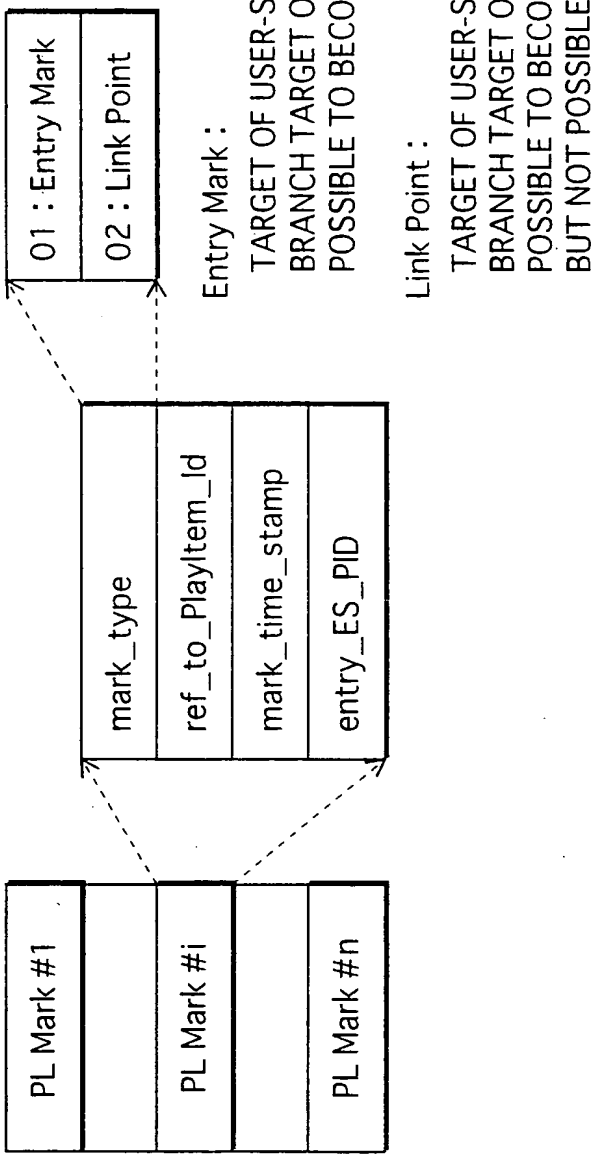

01 : Entry Mark
02 : Link Point
mark_type
ref_to_PlayItem_Id
mark_time_stamp
entry_ES_PID
PL Mark #1
PL Mark #i
PL Mark #n
Entry Mark :
TARGET OF USER-SKIP (i)
BRANCH TARGET OF LINK COMMAND (ii)
POSSIBLE TO BECOME (i) or (ii)
Link Point :
TARGET OF USER-SKIP (i)
BRANCH TARGET OF LINK COMMAND (ii)
POSSIBLE TO BECOME (ii),
BUT NOT POSSIBLE TO BECOME (i)

FIG.17

FIG.18

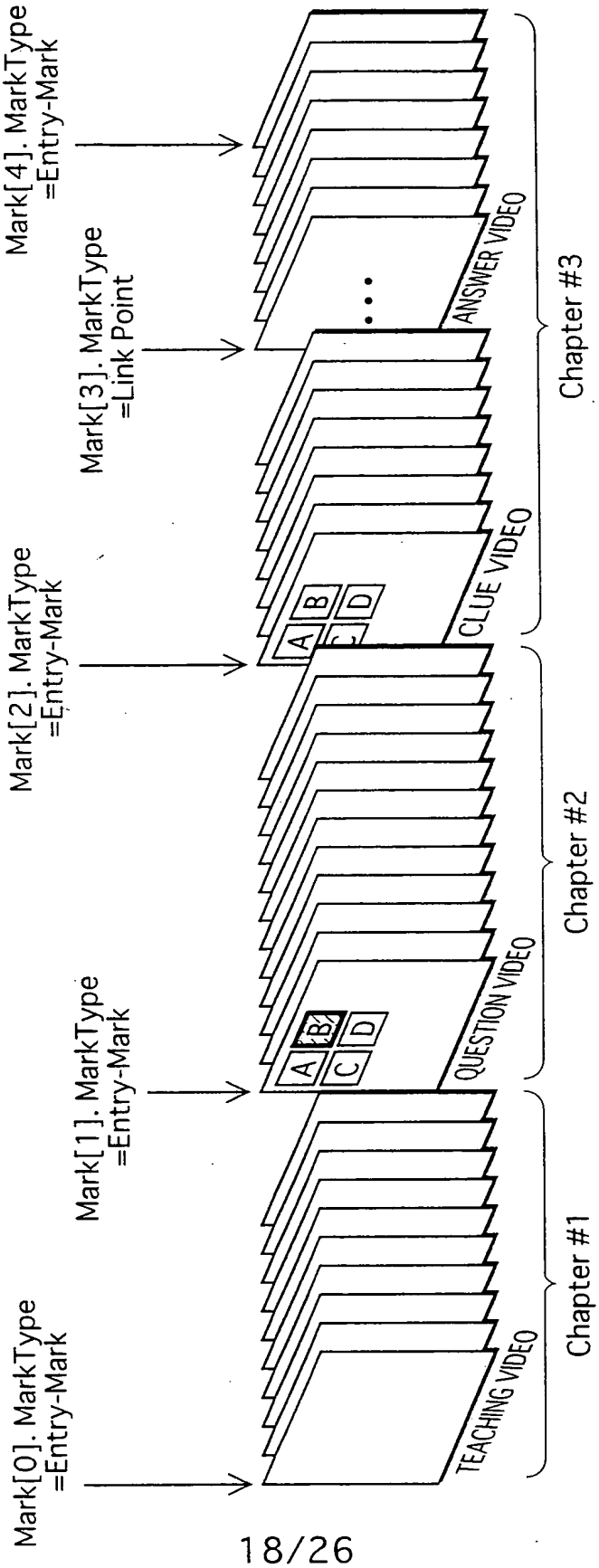
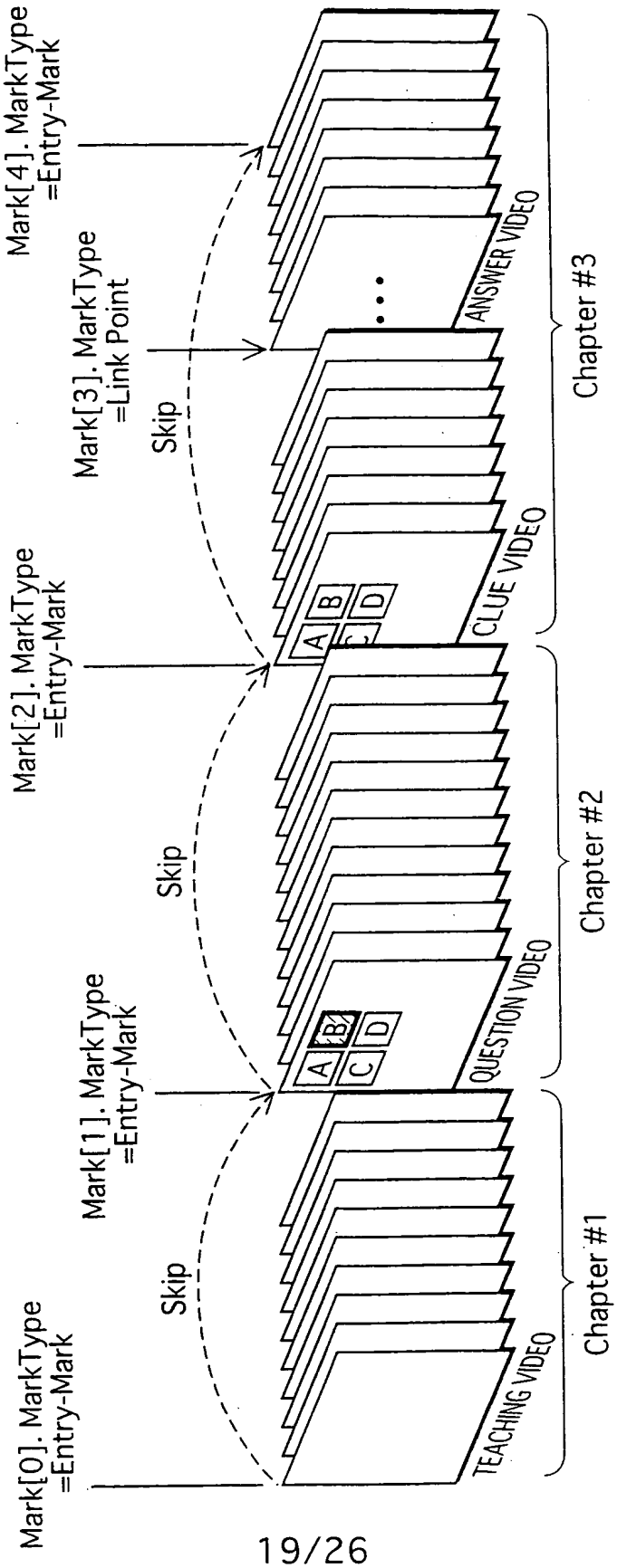

Mark[4]. MarkType
=Entry-Mark
Mark[3]. MarkType
=Link Point
Mark[2]. MarkType
=Entry-Mark
Mark[1]. MarkType
=Entry-Mark
Mark[0]. MarkType
=Entry-Mark
ANSWER VIDEO
CLUE VIDEO
QUESTION VIDEO
TEACHING VIDEO
A
B
C
D
Chapter #3
Chapter #2
Chapter #1

FIG.19


Mark[4]. MarkType
=Entry-Mark
Mark[3]. MarkType
=Link Point
Mark[2]. MarkType
=Entry-Mark
Mark[1]. MarkType
=Entry-Mark
Mark[0]. MarkType
=Entry-Mark
Skip
Skip
Skip
ANSWER VIDEO
CLUE VIDEO
QUESTION VIDEO
TEACHING VIDEO
A
B
C
D
Chapter #3
Chapter #2
Chapter #1

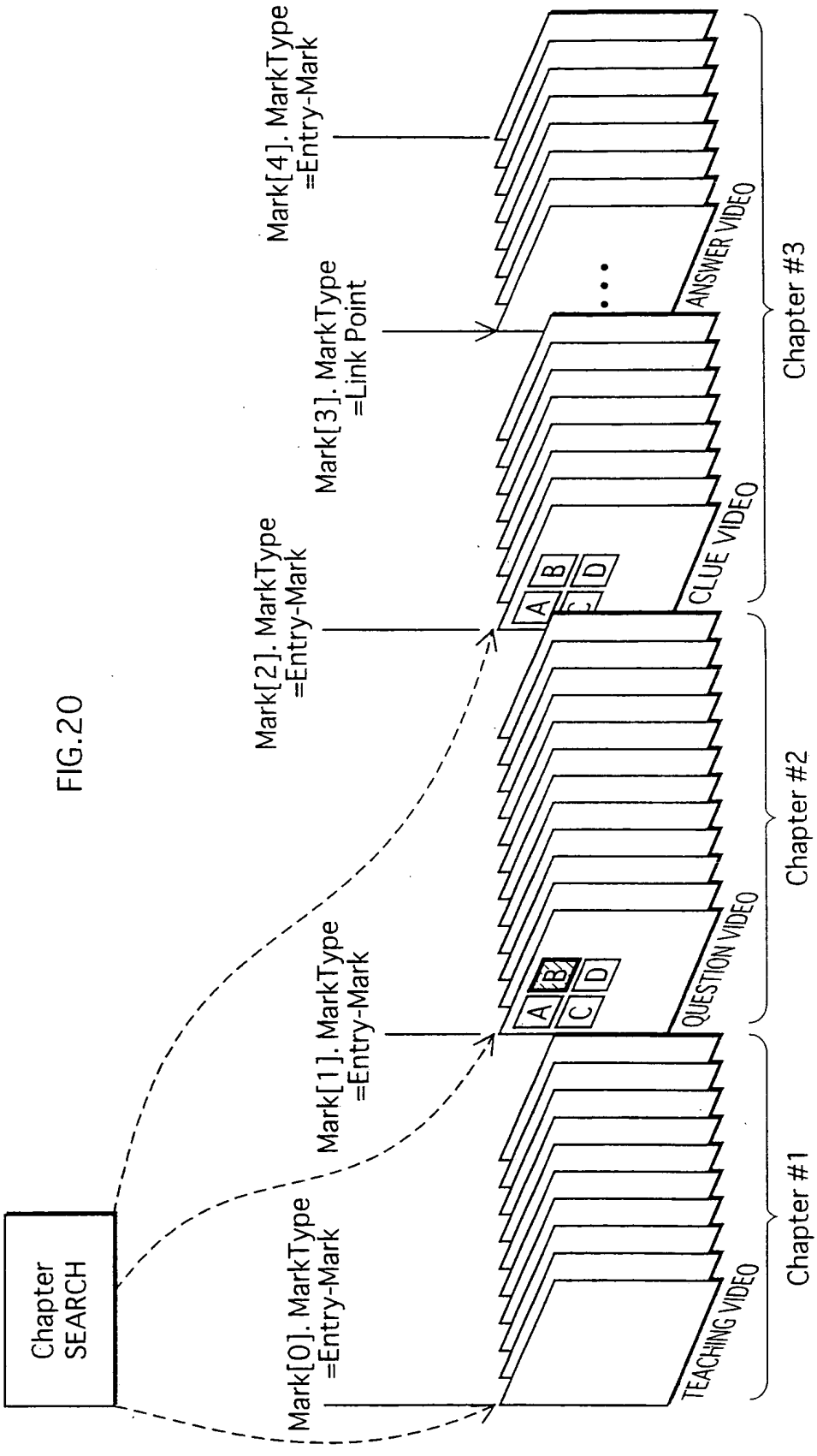

Chapter SEARCH
Mark[0]. MarkType =Entry-Mark
Mark[1]. MarkType =Entry-Mark
Mark[2]. MarkType =Entry-Mark
Mark[3]. MarkType =Link Point
Mark[4]. MarkType =Entry-Mark
TEACHING VIDEO
QUESTION VIDEO
CLUE VIDEO
ANSWER VIDEO
A
B
C
D
Chapter #1
Chapter #2
Chapter #3

FIG.20

FIG.21

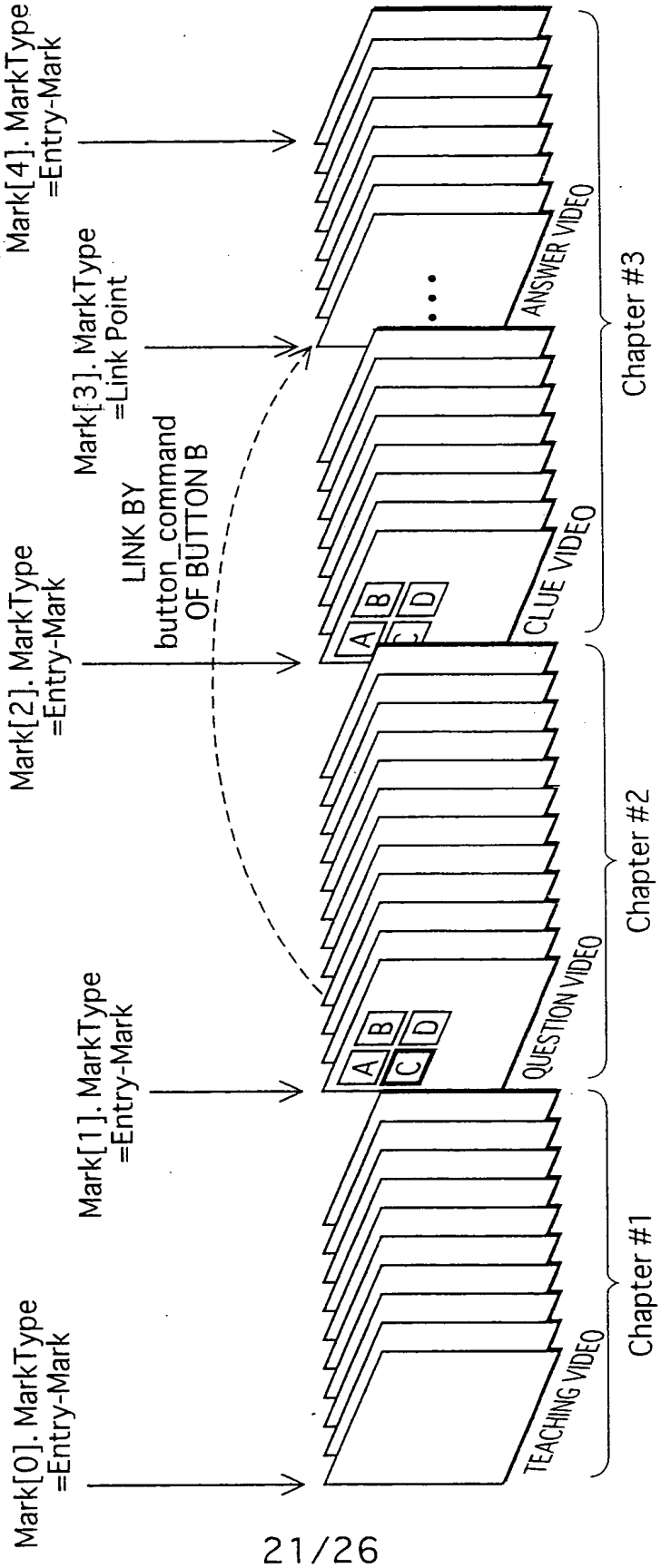

Mark[4]. MarkType
=Entry-Mark
Mark[3]. MarkType
=Link Point
LINK BY
button_command
OF BUTTON B
Mark[2]. MarkType
=Entry-Mark
Mark[1]. MarkType
=Entry-Mark
Mark[0]. MarkType
=Entry-Mark
ANSWER VIDEO
CLUE VIDEO
QUESTION VIDEO
TEACHING VIDEO
A
B
C
D
Chapter #3
Chapter #2
Chapter #1

FIG.22

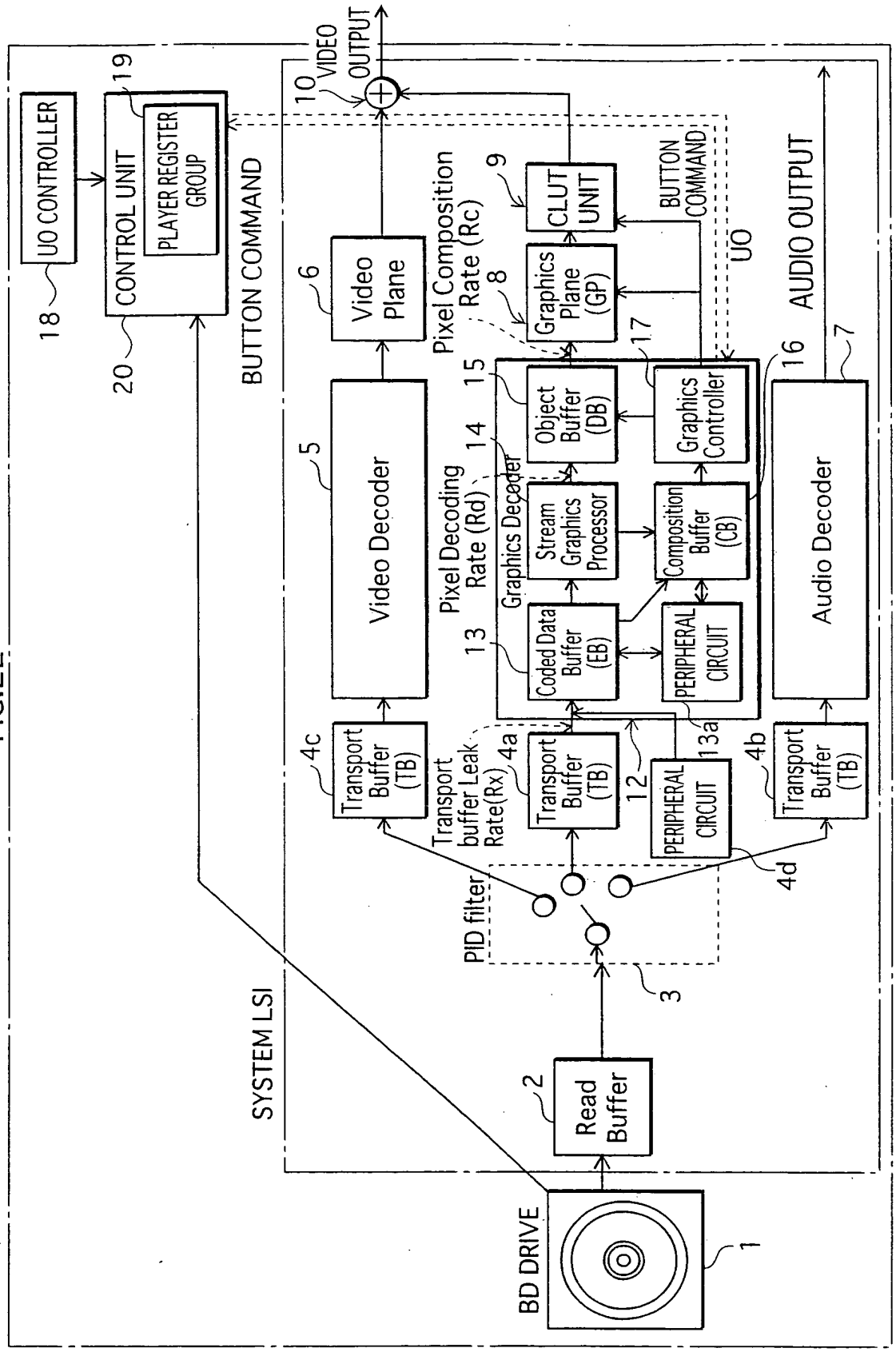

BD DRIVE
1
Read Buffer
2
SYSTEM LSI
PID filter
3
Transport Buffer (TB)
4a
Transport Buffer (TB)
4b
Transport Buffer (TB)
4c
PERIPHERAL CIRCUIT
4d
Transport buffer Leak Rate(Rx)
12
PERIPHERAL CIRCUIT
13a
Coded Data Buffer (EB)
13
Graphics Decoder
Pixel Decoding Rate (Rd)
14
Stream Graphics Processor
Composition Buffer (CB)
Object Buffer (DB)
15
Graphics Controller
16
17
Video Decoder
5
Audio Decoder
7
Video Plane
6
Graphics Plane (GP)
8
Pixel Composition Rate (Rc)
CLUT UNIT
9
VIDEO OUTPUT
10
AUDIO OUTPUT
UO
BUTTON COMMAND
BUTTON COMMAND
CONTROL UNIT
20
PLAYER REGISTER GROUP
19
UO CONTROLLER
18

FIG.23

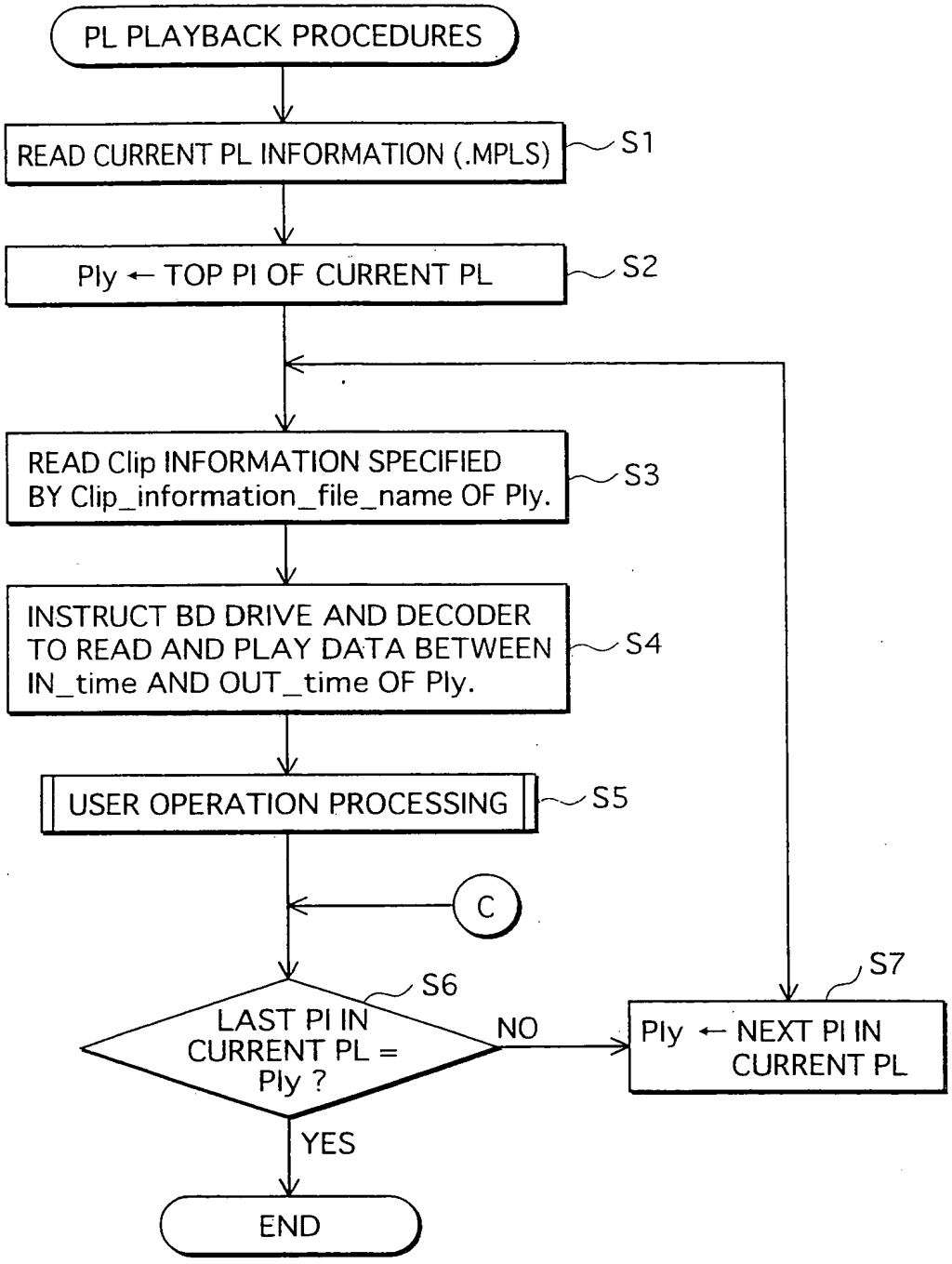

PL PLAYBACK PROCEDURES
READ CURRENT PL INFORMATION (.MPLS)
S1
Ply ← TOP PI OF CURRENT PL
S2
READ Clip INFORMATION SPECIFIED BY Clip_information_file_name OF Ply.
S3
INSTRUCT BD DRIVE AND DECODER TO READ AND PLAY DATA BETWEEN IN_time AND OUT_time OF Ply.
S4
USER OPERATION PROCESSING
S5
C
S6
LAST PI IN CURRENT PL = Ply ?
NO
S7
Ply ← NEXT PI IN CURRENT PL
YES
END

FIG.24

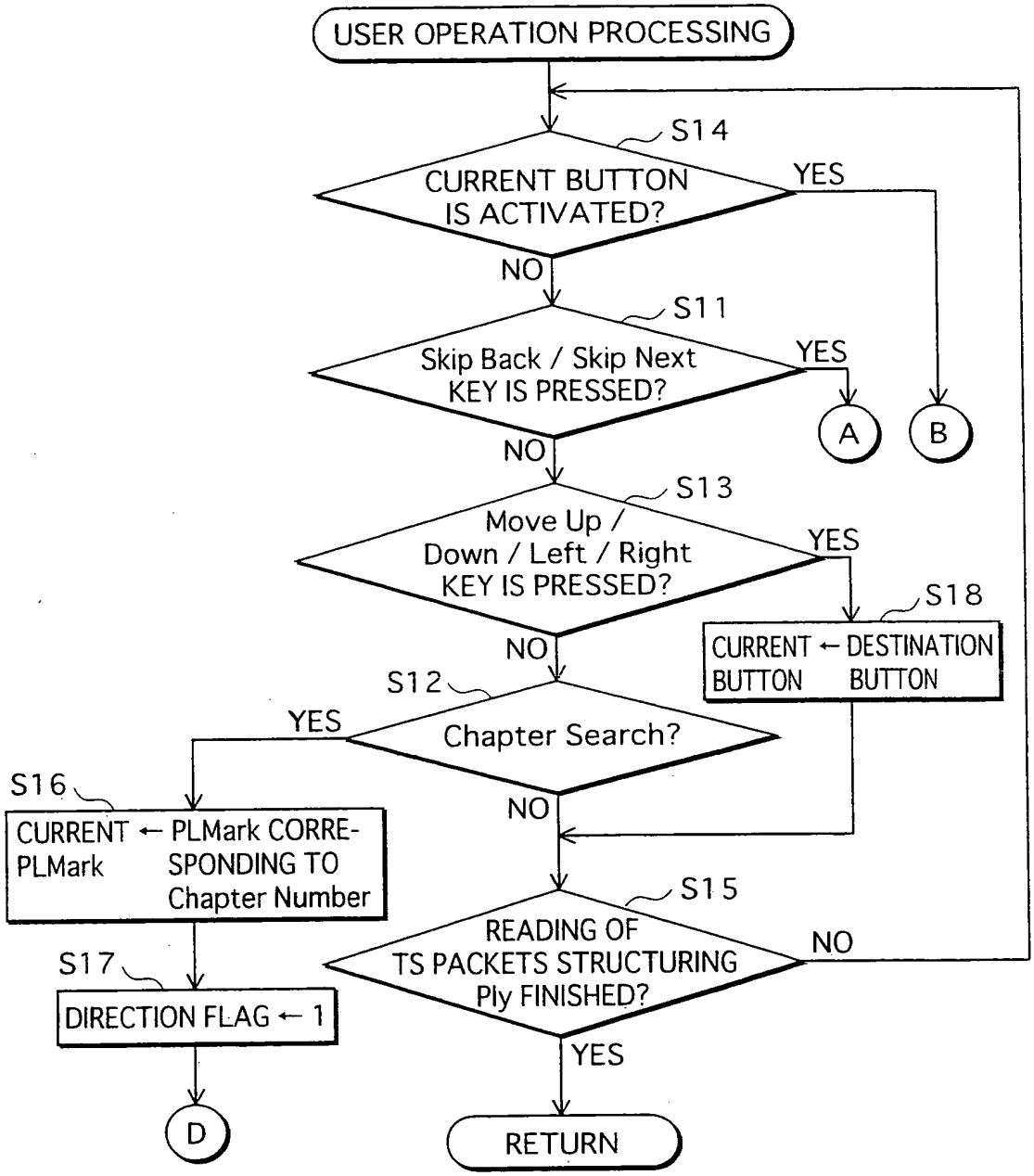

USER OPERATION PROCESSING
S14
CURRENT BUTTON IS ACTIVATED?
YES
NO
S11
Skip Back / Skip Next KEY IS PRESSED?
YES
A
B
NO
S13
Move Up / Down / Left / Right KEY IS PRESSED?
YES
S18
CURRENT BUTTON ← DESTINATION BUTTON
NO
S12
Chapter Search?
YES
S16
CURRENT PLMark ← PLMark CORRESPONDING TO Chapter Number
NO
S15
READING OF TS PACKETS STRUCTURING Ply FINISHED?
NO
S17
DIRECTION FLAG ← 1
YES
D
RETURN

FIG.25

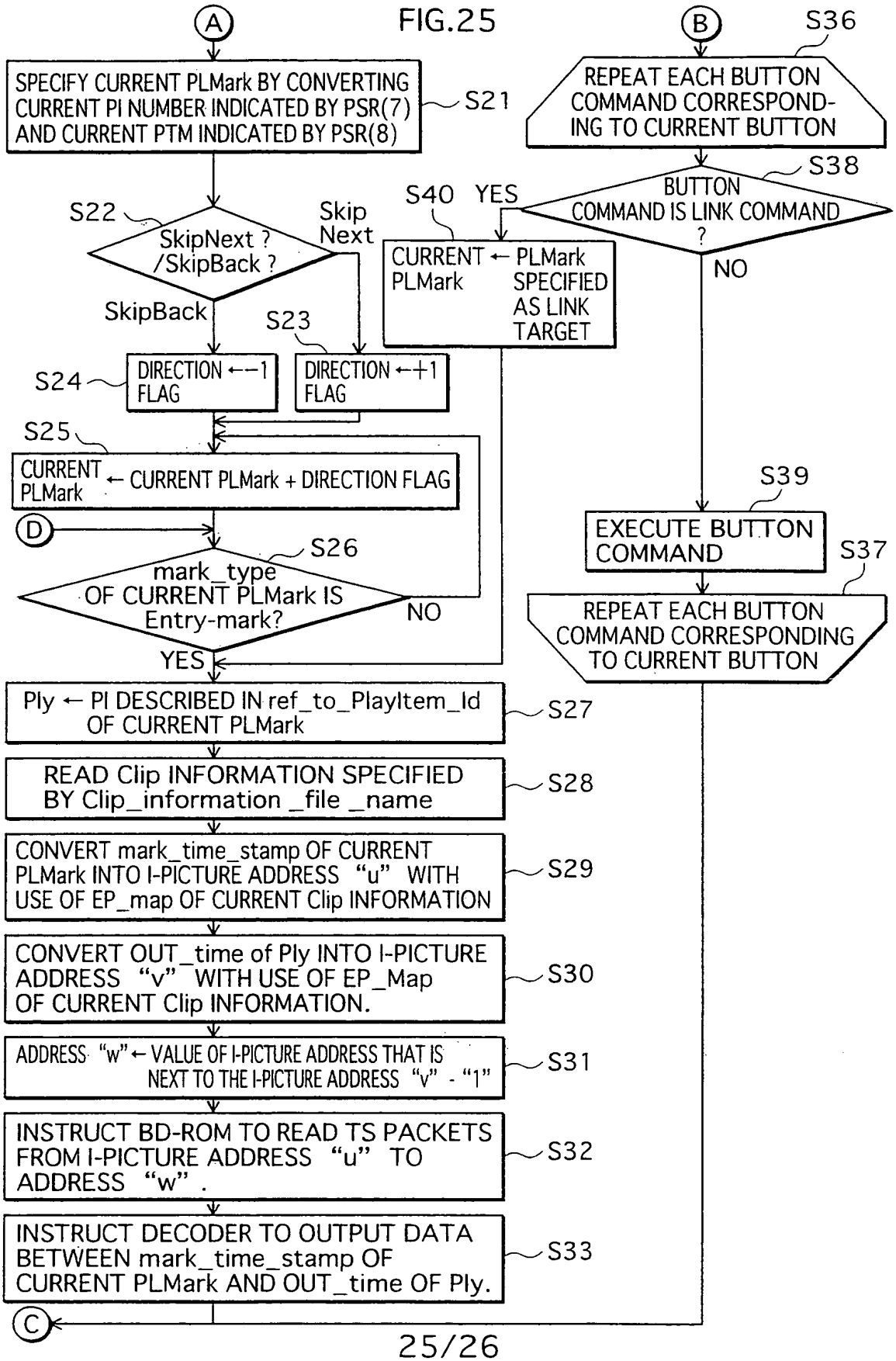
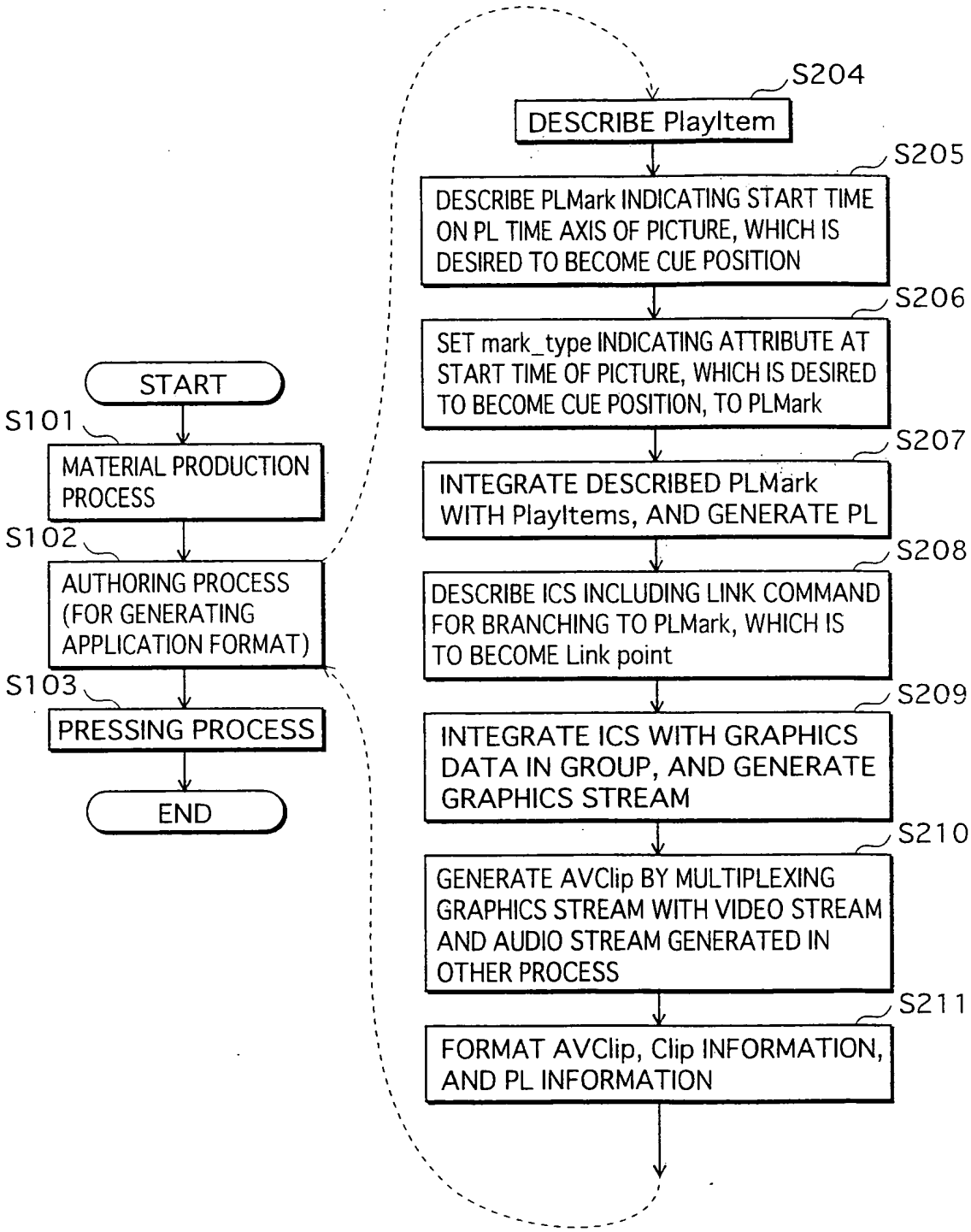

A
SPECIFY CURRENT PLMark BY CONVERTING CURRENT PI NUMBER INDICATED BY PSR(7) AND CURRENT PTM INDICATED BY PSR(8)
S21
S22
SkipNext ? /SkipBack ?
Skip Next
SkipBack
S23
S24
DIRECTION ← −1 FLAG
DIRECTION ← +1 FLAG
S25
CURRENT PLMark ← CURRENT PLMark + DIRECTION FLAG
D
S26
mark_type OF CURRENT PLMark IS Entry-mark?
NO
YES
Ply ← PI DESCRIBED IN ref_to_PlayItem_Id OF CURRENT PLMark
S27
READ Clip INFORMATION SPECIFIED BY Clip_information _file _name
S28
CONVERT mark_time_stamp OF CURRENT PLMark INTO I-PICTURE ADDRESS "u" WITH USE OF EP_map OF CURRENT Clip INFORMATION
S29
CONVERT OUT_time of Ply INTO I-PICTURE ADDRESS "v" WITH USE OF EP_Map OF CURRENT Clip INFORMATION.
S30
ADDRESS "w" ← VALUE OF I-PICTURE ADDRESS THAT IS NEXT TO THE I-PICTURE ADDRESS "v" - "1"
S31
INSTRUCT BD-ROM TO READ TS PACKETS FROM I-PICTURE ADDRESS "u" TO ADDRESS "w" .
S32
INSTRUCT DECODER TO OUTPUT DATA BETWEEN mark_time_stamp OF CURRENT PLMark AND OUT_time OF Ply.
S33
C
B
S36
REPEAT EACH BUTTON COMMAND CORRESPONDING TO CURRENT BUTTON
S38
BUTTON COMMAND IS LINK COMMAND ?
S40
YES
NO
CURRENT PLMark ← PLMark SPECIFIED AS LINK TARGET
S39
EXECUTE BUTTON COMMAND
S37
REPEAT EACH BUTTON COMMAND CORRESPONDING TO CURRENT BUTTON

FIG.26


START
S101
MATERIAL PRODUCTION PROCESS
S102
AUTHORING PROCESS (FOR GENERATING APPLICATION FORMAT)
S103
PRESSING PROCESS
END
S204
DESCRIBE PlayItem
S205
DESCRIBE PLMark INDICATING START TIME ON PL TIME AXIS OF PICTURE, WHICH IS DESIRED TO BECOME CUE POSITION
S206
SET mark_type INDICATING ATTRIBUTE AT START TIME OF PICTURE, WHICH IS DESIRED TO BECOME CUE POSITION, TO PLMark
S207
INTEGRATE DESCRIBED PLMark WITH PlayItems, AND GENERATE PL
S208
DESCRIBE ICS INCLUDING LINK COMMAND FOR BRANCHING TO PLMark, WHICH IS TO BECOME Link point
S209
INTEGRATE ICS WITH GRAPHICS DATA IN GROUP, AND GENERATE GRAPHICS STREAM
S210
GENERATE AVClip BY MULTIPLEXING GRAPHICS STREAM WITH VIDEO STREAM AND AUDIO STREAM GENERATED IN OTHER PROCESS
S211
FORMAT AVClip, Clip INFORMATION, AND PL INFORMATION